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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/595,157

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Toshiaki Takenaka

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EXAMINER

GOFF II, JOHN L

ART UNIT

PAPER NUMBER

1746

NOTIFICATION DATE

DELIVERY MODE

02/03/2011

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/595,157	Applicant(s) TAKENAKA ET AL.	
	Examiner John L. Goff	Art Unit 1746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 April 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 and 6-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-10, 15 and 16 is/are rejected.
- 7) ☒ Claim(s) 11-14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>12/22/10</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 4/28/10 has been entered.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 103

3. Claims 1, 3, and 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art (Figure 6 and Specification pages 1-4, 8, and 9) in view of Kueneman et al. (U.S. Patent 4,081,600) as evidenced by "Material Expansion Coefficients" (Pages 17-1-17-12).

The admitted prior art discloses a conventional method of manufacturing a multi-layer circuit board comprising providing a structure including a core circuit board (30) having a circuit pattern (31a, 31b) thereon and a thermal expansion coefficient (TCE) in a range of $10 \times 10^{-6}/^{\circ}\text{C}$ to $12 \times 10^{-6}/^{\circ}\text{C}$ and a prepreg sheet (21a, 21b) having a through-hole (24) filled with conductive paste sandwiched between a pair of copper foils (25a, 25b) further sandwiched between a pair of lamination plates (26a, 26b) and applying heat and pressure to form a laminated structure (Figures 6A-6D and Page 3, line 6 to Page 4, line 8). The admitted prior art does not specifically

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teach the lamination plates have a TCE equivalent to a TCE of the core circuit board, it being noted “equivalent” is considered a permissible range of $\pm 20\%$ in view of applicants definition on page 13, lines 17-20. The admitted prior art teaches the lamination plates are usually formed of material having a coefficient of linear expansion to that of the copper foil, e.g. $18 \times 10^{-6}/^{\circ}\text{C}$.

Kueneman is exemplary of a similar method of manufacturing a circuit board including the use of lamination plates where the plates are formed of stainless steel (TCE of $16-17.3 \times 10^{-6}/^{\circ}\text{C}$), aluminum (TCE of $23.6 \times 10^{-6}/^{\circ}\text{C}$), copper (TCE of $16.5-17.7 \times 10^{-6}/^{\circ}\text{C}$), nickel (TCE of $13.3 \times 10^{-6}/^{\circ}\text{C}$), or titanium (TCE of $8.5 \times 10^{-6}/^{\circ}\text{C}$) (Column 6, lines 13-25 and Column 10, lines 49-64), it being noted the TCE values were taken from “Material Expansion Coefficients” (Pages 17-1-17-12). Absent a quantitative showing of unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use as the lamination plates in the admitted prior art any of the materials known as suitable in the art for the same purpose such as nickel or titanium as shown by Kueneman where lamination plates formed from nickel or titanium have a TCE equivalent to the TCE of the core circuit board and smaller than the TCE of the copper foils.

It is noted Figure 8 of applicants admitted prior art depicts a different result than Figure 4 of applicants invention. However, the Figures alone are not considered sufficient evidence of unexpected results. There is no indication that the Figures are drawn to scale as a result of an experiment. There is no quantitative measurement for “F” in each of the Figures. Further, even if the quantitative values were present the claims are not commensurate in scope with the Figures as the depicted results are a function of using a thin prepreg sheet where the thickness of the sheet is not disclosed in the specification such that it is not clear what thickness must be claimed

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for the claims to be commensurate in scope with any unexpected result derived from using a thin prepreg sheet.

Regarding claims 3 and 6, the admitted prior art teaches the core circuit board has four or more layers. The admitted prior art teaches the core circuit board and the prepreg sheet are alternately laminated so as to have two or more layers.

Regarding claims 7 and 8, the admitted prior art further teaches a buffer material and a carrying plate, i.e. a heat press plate, disposed at an outside of the structure wherein the structure undergoes heat and pressure through the buffer material and the carrying plate. The buffer material is considered formed of commercial buffer material, i.e. a material capable of accommodating differences in TCE between the lamination plates and carrying plate the same as applicants use of the same. It is not clear what material the carrying plate is formed of such that it would have been obvious to one of ordinary skill in the art at the time the invention was made to use as the material of the carrying plates in the admitted prior art as modified Kueneman the same material as the lamination plates as each plate has the same function of conducting heat and pressing the structure.

Regarding claim 9, the admitted prior art teaches the prepreg sheet contains a base and a resin layer impregnated with the base to form a resin layer on both surfaces of the base.

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art and Kueneman as applied to claims 1, 3, and 6-9 above, and further in view of Ikeguchi et al. (JP 57011026 and see also the abstract).

The admitted prior art as applied above teaches all of the limitations in claim 2 except for a specific teaching that the thickness of the resin layer formed on both sides of the base is at least

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20 microns in total thickness. Ikeguchi disclose a prepreg excellent in workability comprising a base and a resin layer impregnated with the base to form a resin layer on both sides of the base having at least 20 microns in total thickness (See the abstract). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the resin layers on both sides of the base as taught by the admitted prior art as modified by Kueneman with a thickness at least 20 microns in total as shown by Ikeguchi to form a prepreg excellent in workability.

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art and Kueneman as applied to claims 1, 3, and 6-9 above, and further in view of Shirasawa et al. (U.S. Patent 4,614,559).

The admitted prior art as applied above teaches all of the limitations in claim 4 except for a specific teaching that the core circuit board is not less than one time as thick as the prepreg sheet. Shirasawa directed to manufacturing a multi-layer circuit board comprising core circuit boards and prepreg sheets teach the layers are desirably as thin as possible to form a dimensionally stable board including specifically demonstrating the core circuit boards are not less than one time as thick as the prepreg sheets (Column 1, lines 33-35 and Tables 1 and 2). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use as the core circuit board and prepreg sheet in the admitted prior art as modified by Kueneman layers as thin as possible including wherein the core circuit board is not less than one time as thick as the prepreg sheet as shown by Shirasawa to form a multi-layer circuit board that is thin and dimensionally stable.

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6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art and Kueneman as applied to claims 1, 3, and 6-9 above, and further in view of Del (U.S. Patent 4,180,608).

The admitted prior art as applied above teaches all of the limitations in claim 10 except for a specific teaching that the base is woven and the resin is B-staged. It is considered extremely well known in the art that a prepreg generally comprises a woven base and a B-staged resin as evidenced by Del (Column 4, lines 23-27). It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the prepreg taught by the admitted prior art as modified by Kueneman as was generally well known including a woven base and a B-staged resin as evidenced by Del only the expected results being achieved.

7. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art and Kueneman as applied to claims 1, 3, and 6-9 above, and further in view of Hashimoto et al. (U.S. Patent 6,492,030).

The admitted prior art as applied above teaches all of the limitations in claim 15 except for a specific teaching that the thickness of the prepreg is 70 μm , it being noted the admitted prior art is not limited to any particular thickness. It is considered conventional in the art that a prepreg such as that used in the admitted prior art has a thickness of 30 to 100 μm as shown by Hashimoto (Column 2, lines 31-33). Absent any unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use as the thickness of the prepreg in the admitted prior art as modified by Kueneman a conventional thickness such as 70 μm as shown by Hashimoto only the expected results being achieved.

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8. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art, Kueneman, and Hashimoto as applied to claim 15 above, and further in view of Del.

The admitted prior art as modified above teach all of the limitations in claim 15 except for a specific teaching that the thickness of the prepreg after pressing is 60 μm , it being noted the admitted prior art is not limited to any particular thickness. It is known that a prepreg after pressing results in a reduced thickness as shown by Del (Column 7, lines 33-35). Absent any unexpected results, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use as the thickness of the prepreg in the admitted prior art as modified by Kueneman and Hashimoto any conventional thickness such as 70 to 60 μm as shown by Hashimoto wherein the thicknesses are chosen as a function of the thickness of the prepreg reducing during pressing as evidenced by Del.

Allowable Subject Matter

9. Claims 11-14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The prior art of record fails to teach or suggest a method of manufacturing a multi-layer circuit board as claimed including where the TCE of the core circuit board is in a range of $10 \times 10^{-6}/^{\circ}\text{C}$ to $12 \times 10^{-6}/^{\circ}\text{C}$, the TCE of the lamination plates is equivalent to the TCE of the core circuit board, and wherein the metal foil is made of copper (TCE of $16.5\text{-}17.7 \times 10^{-6}/^{\circ}\text{C}$) and the additional steps of measuring the TCE of the core circuit board; and selecting the pair of

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lamination plates such that the TCE of the pair of lamination plates is equivalent to the measured TCE of the core circuit board. Yuhas et al. (U.S. Patent 5,464,658) disclose measuring the TCE of the core circuit board. However, the TCE of the core circuit board is not within the claimed range, and measuring the TCE of the core circuit board is done to match the TCE of the core circuit board with that of the copper foil, i.e. Yuhas teaches away from that claimed including where the TCE of the core circuit board is in a range of $10 \times 10^{-6}/^{\circ}\text{C}$ to $12 \times 10^{-6}/^{\circ}\text{C}$ and the metal foil is made of copper (TCE of $16.5\text{-}17.7 \times 10^{-6}/^{\circ}\text{C}$). Pommer (U.S. Patent 6,560,844) discloses selecting an alignment plate such that the TCE of the alignment plate is the same or approximately the same as the TCE of the layers, i.e. the core circuit board, prepreg, and copper foils, suggesting a copper plate is suitable. However, Pommer teaches that in addition to the alignment plate having the same or approximately the same TCE that the layers have substantially similar TCEs with the greatest difference in TCE between any two layers is less than 2 ppm, i.e. Pommer teaches away from that claimed including where the TCE of the core circuit board is in a range of $10 \times 10^{-6}/^{\circ}\text{C}$ to $12 \times 10^{-6}/^{\circ}\text{C}$ and the metal foil is made of copper (TCE of $16.5\text{-}17.7 \times 10^{-6}/^{\circ}\text{C}$) as the TCEs are not substantially similar and exceed the difference taught by Pommer.

Response to Arguments

10. Applicant's arguments with respect to claims 1-4 and 6-16 have been considered but are moot in view of the new ground(s) of rejection.

Applicants amendment has overcome the previous prior art rejections. The new limitations are fully addressed above.

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Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **John L. Goff** whose telephone number is **(571)272-1216**. The examiner can normally be reached on M-F (7:30 AM - 4:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Katarzyna Wyrozebski can be reached on (571) 272-1127. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John L. Goff/
Primary Examiner, Art Unit 1746